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# A NEW SPECIES OF *GOBIOLAGUS* (LAGOMORPHA, MAMMALIA) FROM THE MIDDLE EOCENE OF SHANXI PROVINCE, CHINA

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## ABSTRACT

A new species of the relatively derived lagomorph *Gobiolagus* is reported from Irdinmanhan aged deposits of the Yuanqu Basin. The species is more primitive than other known species of the genus, which were known previously from Inner Mongolia and Mongolia. *Gobiolagus* is unique in the morphology of the maxilla and is precociously derived in its hypsodonty, but does not appear to be closely related to other known Eocene lagomorphs. A second, very incompletely represented, leporid is also present in the same locality.

KEY WORDS: Middle Eocene, Lagomorpha, Leporidae, Guojiazhuang fauna

## INTRODUCTION

Lagomorpha are relatively well known and also taxonomically diverse in the Middle Eocene of eastern Asia. At least five genera, *Lushilagus, Strenulagus, Shamolagus, Gobiolagus*, and *Desmatolagus* have been reported in Irdinmanhan through Ergilian localities in China and Mongolia. Most of these genera are similar morphologically except for dental characters, which exhibit a small variety of differences, some related to stage of evolution. The most morphologically distinctive of these genera is *Gobiolagus*, which has been reported from the Sharamurunian of Inner Mongolia, and questionably from the Ergilian (Burke, 1941; Qi, 1988).

A new species of *Gobiolagus* occurs in the locality of Huoshipo near Guojia village in Yuanqu County of southern Shanxi Province (Huang et al., 1999). This locality appears to be the stratigraphically lowest of the currently known fossiliferous horizons in the Yuli member of the Heti Formation. The new Guojiazhuang fauna can be tentatively considered to be Irdinmanhan in age (Huang et al., 2001), although completion of the faunal analysis and a pending magnetostratigraphic study could modify this biostratigraphic correlation.

## SYSTEMATIC PALEONTOLOGY

### Order Lagomorpha Brandt, 1855
### Family ?Leporidae Gray, 1821
### *Gobiolagus* Burke, 1941

*Introduction.*—The distinctive nature of a series of Asian lagomorph species was

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recognized by Burke (1941), who established the genus *Gobiolagus* on the basis of lower jaws from the Sharamurunian (*G. tolmachovi*) and Ergilian (*G. andrewsi*) of Inner Mongolia. Two additional species were referred with question to *Gobiolagus*, the Ergilian *G.* (?)*major* and the Hsandgolian *G.* (?)*teilhardi*. Restudy of the last species led to its separation as a new genus, *Ordolagus* (de Muizon, 1977; Huang, 1986). *Gobiolagus* is recognized as being clearly distinct from other Middle and Late Eocene lagomorphs in a number of characteristics of the lower dentition, including its precocious unilateral hypsodonty, buccally expanded trigonids of $P_4$-$M_2$, and the reduction, especially buccally, of the premolar talonids. $M_1$ and $M_2$ are distinctly wider transversely than the other lower cheek teeth.

Qi (1988) recognized that a maxilla having $P^4$-$M^3$, IVPP (Institute of Vertebrate Paleontology and Paleoanthropology) V 8430, from the Shara Murun area of Inner Mongolia represents the previously unknown upper jaw and teeth of *Gobiolagus tolmachovi*. Reference of this specimen to *Gobiolagus* was based on several factors including the fact that it is not referable to any of the other Asian Eocene genera, *Lushilagus, Shamolagus, Strenulagus*, and *Desmatolagus*. Characters of distinction in the upper dentition of *Gobiolagus tolmachovi* include the molariform $P^4$, which lacks a crescentic valley after moderate wear, the transversely wide but anteroposteriorly short $M^{1-2}$, and the absence of any hypostriae. IVPP V 8430 revealed some very important features of the maxilla itself: an elongate, shallow fossa anterior to the zygomatic process; the large and oval infraorbital foramen; a premolar foramen on the palate medial to $P^4$. The specimen is also striking in the marked convexity of the edge of the maxilla buccal to the tooth row, with greatest expansion in line with $M^1$ and a distinct narrowing medially both anterior and posterior to this expansion. This shape of the maxilla does not occur in the other Eocene lagomorph genera, but is found also in the new species from Huoshipo described below.

## *Gobiolagus lii*, new species

?*Lushilagus* sp. Huang et al., 2001:91.

*Holotype*.—IVPP V 12755, partial right maxilla with $P^3$-$M^2$.

*Locality and Horizon*.—Huoshipo, Guojia village, Yuanqu County, Shanxi Province; Yuli member of the Heti Formation; Middle Eocene (Irdinmanhan).

*Diagnosis*.—Differs from *G. tolmachovi* in being smaller, having much less well-developed buccal cuspules on $P^4$ and $M^1$, and non-molariform $P^4$.

*Etymology*.—The species name honors our mentor and colleague Chuan-kuei Li, respected paleontologist and student of the vast diversity of gliriform mammals.

*Description*.—The maxilla (Fig. 1) is characterized by a strongly convex outline buccal to the cheek teeth, with its greatest width at $M^1$. The anterior surface of the zygomatic process is in line with the anterior part of $P^4$. The maxilla is somewhat broken laterally but does have a long ridge extending in an anterior and slightly dorsal direction from the process to the relatively large, oval infraorbital foramen. Ventral to the ridge is a pronounced furrow. The structure suggests that the orbit was longer than in *Shamolagus* (Li, 1965) and other early leporids. A premolar foramen occurs in the maxilla on the palate, medial to $P^3$.

The anteroposteriorly narrow cheek teeth are well worn. They are unilaterally hypsodont, with curved shafts and two buccal roots on $P^4$-$M^2$. On $P^3$-$M^1$ the talon is worn more deeply than are the more anterior parts of the teeth. The large, rounded alveolus of $P^2$ indicates a single root. $P^3$ is composed of three lobes, of which the lingual is the largest and the rounded central lobe protrudes farthest anteriorly. $P^4$ has an isolated crescentic valley, and an indistinct remnant of a shallow buccal fold. $M^{1-2}$ are larger than the premolars (Table 1). $M^1$, the widest tooth, has an indistinct rounded island in the center of the occlusal surface, presumably the remnant of an external reentrant. On $M^2$ the trigon protrudes farther buccally than the talon. There is a single posterobuccal fold that crosses

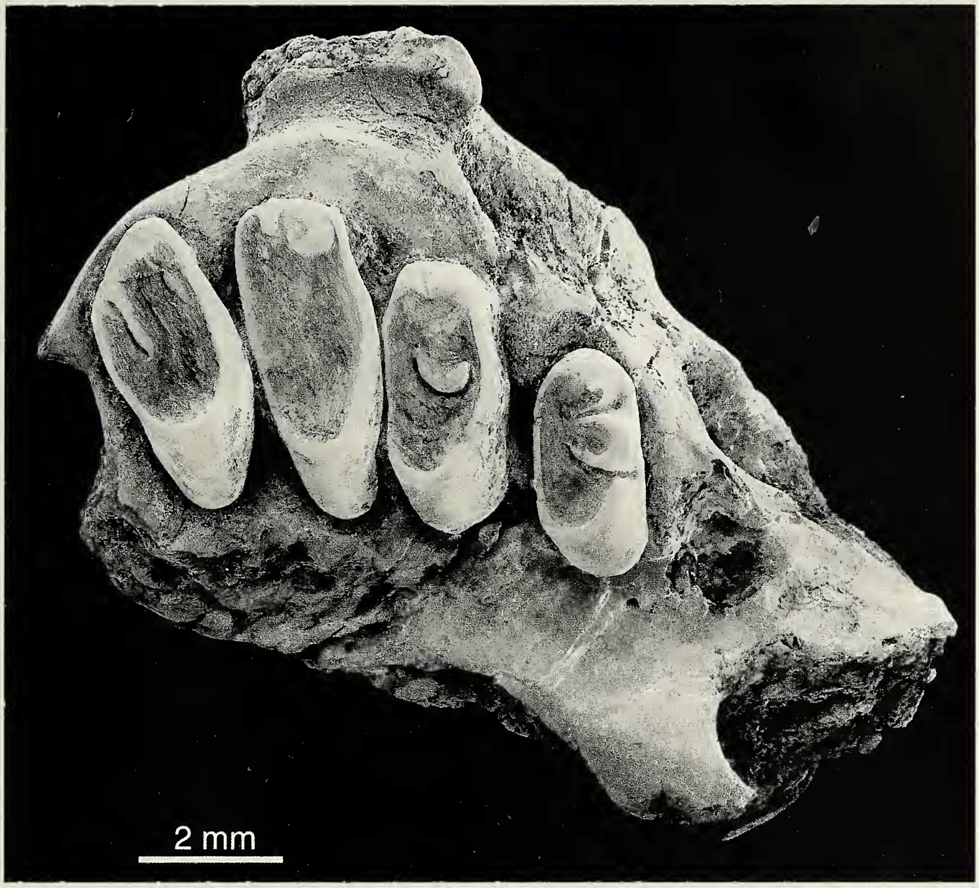

Fig. 1.—*Gobiolagus lii*, holotype, IVPP V 12755, occlusal view of right maxilla with $P^3$-$M^2$.

less than half of the tooth width and has thicker enamel on its anterior than posterior wall. $M^3$ appears from its alveolus to have been relatively well developed.

*Comparisons.*—*Gobiolagus lii* resembles *G. tolmachovi* in the shape of the maxilla, zygoma, and infraorbital foramen, and in possessing a premolar foramen. All other Middle Eocene lagomorphs have a much less convex alveolar border and lack the premolar foramen. *G. lii* is clearly a less derived species than *G.*

Table 1.—*Measurements (in mm) of* Gobiolagus *(l = anteroposterior; w = width).*

| Tooth | *G. tolmachovi* from Qi, 1988) | *G. lii* |
|---|---|---|
| $P^2$ l/w | 1.4/2.0 | — |
| $P^3$ l/w | 1.9/4.1 | 1.36/2.37 |
| $P^4$ l/w | 1.4/5.2 | 1.42/2.7 |
| $M^1$ l/w | 2.0/6.9 | 1.8/3.4 |
| $M^2$ l/w | 2.2/6.7 | 1.7/3.05 |
| $M^3$ l/w | 1.7/2.6 | — |

*tolmachovi*, as shown by the non-molariform $P^4$ and the less distinct development of buccal cusps on $P^4$-$M^2$ in the former species.

### Leporid undetermined

*Specimen Examined.*—IVPP V 12179, right $M^2$.

*Locality and Horizon.*—Huoshipo, Guojia village, Yuanqu County, Shanxi Province; Yuli member of the Heti Formation; Middle Eocene (Irdinmanhan).

A second leporid is represented by one very worn $M^2$, which is slightly larger (l/w, 1.9/3.12) than the corresponding tooth of *G. lii*. The tooth also differs from $M^2$ of *G. lii* in having a wider lingual side, lacking the distinct taper found in that species. The only clear remnant of a pattern is a round, enamel-rimmed island near the center of the occlusal surface, presumably the buccal end of an ephemeral hypostria. There is no trace of such an island in *G. lii*, which has more persistent buccal reentrants than in this second leporid.

## DISCUSSION

*Gobiolagus* stands out among the Eocene lagomorphs of China in its precocious unilateral hypsodonty, lingual connection of trigonid and talonid of the lower cheek teeth, distinctive dental pattern with reduced premolar talonids, and transversely widened molars (Burke, 1941). Equally distinctive is the morphology of the maxilla, with a strong curvature buccal to the upper cheek teeth, an anterior position of the zygoma, an oval infraorbital foramen, and a premolar foramen on the palate. The premolar foramen occurs also in some specimens of the Oligocene *Desmatolagus* (Sych, 1975; Huang, 1987) and in all ochotonids. *Gobiolagus* does not appear to be closely allied to either of these groups, and the character can now be regarded as a primitive one among lagomorphs.

Lagomorphs have a very interesting distribution in Asia in the Eocene. They are abundant in presumably Irdinmanhan and Sharamurunian (Middle Eocene) deposits in the provinces of Jiangsu, Henan, and Shanxi in east central China (Qi et al., 1991; Tong, 1997; Huang et al, 2001). However, there are no lagomorphs in the slightly younger Zhaili and Nanbaotou faunas of Shanxi. They are present in the Ergilian ("Ulangochuan") of Mongolia and Inner Mongolia. This later Eocene distribution of lagomorphs appears to reflect their success in the relatively dry northern habitats but their replacement in the more humid south of China by the cricetid, zapodid, eomyid and other rodents that come to play increasingly prominent roles there.

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